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(73) Proprietor: **SHELL OIL COMPANY**
One Shell Plaza P.O. Box 2463
Houston Texas 77001 (US)

(72) Inventor: **Ayers, Ray Roland**
12431 Honeywood Trail
Houston Texas 77077 (US)

(74) Representative: **Dreiss, Hosenthien & Fuhlendorf**
Gerokstrasse 6
D-7000 Stuttgart 1 (DE)

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Description

Background of the Invention

It is difficult to attach lifting lines to a towed body while the towed body is alongside a "mother" ship (see Figure 1). It is considered quite difficult and dangerous for men to reach over the side with grapples and try to put lines on the towed body, particularly when the mother ship is much larger than the towed body.

One conventional way of attaching lines to the towed body is to leave "pigtails" trailing from the towed body. These pigtails are captured using poles and brought onboard the mother ship for attachment to lift lines. However, this procedure may be very cumbersome for recovering, for example, from a 300-foot long mother ship, a seismic subarray (WO—A—83/01046) which may be up to 60 feet long, weigh up to 25,000 pounds, and have attached gear such as seismic guns and umbilical cables which are subject to entanglement. Accordingly, considering both the size, unwieldy dimensions and motion of a seismic subarray, it is desirable to have a recovery system which avoids the manifest problems of the art.

Brief Description of the Drawings

Figure 1 discloses a seismic subarray in a recovered mode suspended alongside a vessel.

Figure 2(a) and end view 2(b) disclose a first step in recovery of the seismic subarray of Figure 1.

Figures 2(c) and 2(d) show subsequent steps in the recovery process.

Figure 3 shows a latch mechanism used in the apparatus of Figures 2(a)—2(d).

Summary of the Invention

The primary purpose of the present invention is to provide a recovery system for lifting a towed body onboard a towing ship, which system is capable of handling a relatively cumbersome body, which may have attached gear subject to entanglement, and which system is orderly, relatively simple in use, and as free of malfunctioning as possible.

Accordingly, there is provided a method an apparatus for recovering a towed body from the water to onboard a towing ship which is under way, including the steps and means for performing the steps, of positioning the towed body alongside the ship; aligning a saddle means laterally with the towed body; deploying a saddle rudder means attached to the saddle means into the water in the vicinity of the towed body; moving the saddle means in coordination with the saddle rudder means to a position directly above the towed body; and lowering the saddle means into engagement with one end of the towed body. The engaged saddle means preferably is restricted from lateral movement on the towed body by a landing rail but permitted to move longitudinally on the towed body by the extent of the landing rail; the saddle means then is moved longitudinally until one end of the landing rail restricts further longitudinal movement of the saddle means, and the saddle means is lowered into engagement with the other end of the towed body. Preferably, the towed body is a seismic subarray, but it can also be a towed "fish", submarine or a smaller boat, recovered from alongside or from the stern of the mother ship. There is also provided an apparatus according to claims 4 and 10.

A recovery system comprising a saddle-like platform for lowering into engagement with a submersible is known from US—A—3 807 335. However there is no provision of laterally positioning the platform with respect to the submersible.

Other purposes, advantages and features of the invention will be apparent to one skilled in the art upon review of the following.

Description of Preferred Embodiments

As shown in Figure 1 a towing ship or "mother" ship 10 which is underway has a towed body 11 (such as a seismic subarray) which is connected via cables (not shown) to a latching saddle (not shown) from overhead transverse lifting beams 12 and 13. Towed body 11 may be a seismic subarray which is connected to ship 10 by umbilical cable 14 as held outboard of the ship by outrigger support arm 15. Such a subarray may be quite long, e.g. 60 feet, and very heavy, e.g. 25,000 pounds. Once the subarray is launched and towed behind ship 10, recovery of the subarray to the position shown in Figure 1 is difficult. Accordingly, the following described method and apparatus are directed to solving this problem.

The preferred apparatus for accomplishing this lift job is shown in Figures 2(a)—2(b) which show a spreader beam arrangement 20 that self-latches to the towed body and works like a "saddle", as hereinafter so termed. Self-locking aft latch 21 and forward latch 22 are on either end of saddle 20. These latches grab pipe rails, i.e., aft landing rail 23 and forward rail 24, that are structurally a part of the top of towed body 11 for lifting purposes. Before saddle 20 is lowered from transverse beams 12 and 13 (see Figure 1) via aft cable 25 and forward cable 26, rudder 28 at the end of a feeler arm 27 is lowered into the water outboard the towed body 11 to be captured (in Figure 2(a) see direction of arrow). Rudder 28 preferably has some effective buoyancy in order to ride near the surface of the water and is inclined to the flow of current (in Figure 2(b) see direction of arrow) so as to cause the feeler arm/rudder combination to "hug" the side of the towed body 11. Use of the feeler arm 27 and rudder 28 gives the operator a true indexing means in lowering the aft end of saddle 20 and aft latch 21 on top of float 11 (in Figure 2(c) see direction of arrow).

The latch 21 (shown in detail in Figure 3) automatically attaches to landing rail 23 upon contact. Although it is not essential, it is preferred that the forward landing rail 24 be transverse to the longitudinal axis of the towed body 11. Because of this choice, once the aft latch 21 is locked on the aft landing rail 23, the towed body 11 is pulled forward until a "stop" (in Figure 2(d)

see left arrow) is contacted on the forward end of the aft landing rail 23. This stop satisfactorily indexes the landing of the forward latch mechanism 22 on the forward landing rail 24 (in Figure 2(d) see right arrow). Once the two latches are engaged and self-latched, the towed vessel 11 may be readily lifted from the water. It is of course feasible to reverse the aft and forward landing rails and/or land the saddle first on the opposite end of the towed body. Also, feeler arm 27 may be movable only in coordination with the saddle, so that the entire end of the saddle is partially lowered in order to get rudder 28 into the water, and then finally lowered in order to engage aft landing rail 23.

Model tests have been performed to demonstrate the feasibility of this method and apparatus in waves to 12 feet in heigh. A significant feature of the invention is that the saddle 20 can be placed above the wave action while the feeler arm 27 and rudder 28 locate the proper position upon which to lower the aft latch 21. Once the aft latch 21 is engaged, the rest of the attachment may be conducted with relative ease, even in rough weather.

Another significant feature of the invention is the proper weight/buoyancy design of the feeler arm/rudder assembly. Preferably, the assembly has very low reserve buoyancy and a relatively small water plane area in order to make it have a low heave response over the spectrum of normally occurring wave periods. This dynamic response property ensures that the feeler arm/rudder assembly will not be tossed about in the water by waves, winds and relative water velocities.

Yet another significant feature of the invention resides in the latches 21 and 22 which are preferably spring loaded horseshoe latches which engage by impact on landing rails 23 and 24. As shown in Figure 3, on either side of each latch are hydraulic cylinders 30 and 31 with built-in springs (not shown) on the rods 32 and 33. The springs preload prawls 34 upon contact (as assisted by the impact force of the saddle 20 landing on rail 23 or 24). Once the rail 23 or 24 moves upward, so as to touch the head of the latch, the prawls 34 spring back in place to close the opening created. The geometry of the latch mechanism is designed so that the landing rail bears against the prawls during the lifting, without subsequent movement of the prawls. The prawls cannot be inadvertently opened by the purposefully undersized hydraulic cylinders without first setting down the towed body in a support structure or "cradle" (to remove the contact pressure on the prawls). This is an inherent safety factor in the invention.

This method and apparatus can be used to lift all forms of towed bodies, like submarines, from alongside or aft of the mother ship.

The foregoing description of the invention is merely intended to be explanatory thereof.

Claims

1. A method for recovering a towed body (11) from the water to onboard a towing ship (10) which is underway, characterised by the steps of positioning the towed body alongside or behind the ship; aligning a saddle means (20) laterally with the towed body; deploying a rudder means (28) attached to the saddle means into the water in the vicinity of the towed body; moving the saddle means in coordination with the rudder to a position directly above the towed body; and lowering the saddle means into engagement with one end of the towed body.

2. The method of Claim 1 wherein the engaged saddle means (20) is restricted from lateral movement on the towed body (11) by an aft landing rail but permitted to move longitudinally on the towed body by the extent of the aft landing rail (23).

3. The method of Claim 2 wherein the saddle means (24) is moved longitudinally until one end of the aft landing rail (23) restricts further longitudinal movement of the saddle means, whereupon the saddle means is lowered and engaged with a forward land rail (24) at the other end of the towed body.

4. An apparatus for recovering a towed body (11) from the water to onboard a towing ship (10) which is underway, characterised by saddle means (20); rudder means (28) attached directly or indirectly via a feeler arm (27) to the saddle (20) and functionable to laterally align the saddle (20) with the towed body (11); and means to engage one end of the saddle means (20) with the towed body (11) and restrict further lateral movement of the saddle means (20).

5. The apparatus of Claim 4 including means for moving the saddle means (20) longitudinally on the towed body (11) into engagement with a lifting rail at the other end of the towed body (11).

6. A method for recovering a seismic subarray of a float (11), fish and umbilical cable from the water to onboard a towing ship (10) which is underway, characterised by the steps of positioning the subarray alongside or behind the ship; aligning a saddle means (20) with the float of the subarray; deploying a rudder means (28) attached to the saddle means into the water in the vicinity of the float; moving the saddle means in coordination with the rudder to a position directly above the float; and lowering the saddle means into engagement with a landing rail (24) on the float.

7. The method of Claim 6 wherein a feeler arm (27) is employed to position the rudder (28) alongside the float (11).

8. The method of Claim 6 wherein the engaged saddle means (20) is restricted from lateral movement on the float (11) but permitted to move longitudinally along the landing rail (23).

9. The method of Claim 8 wherein the saddle means (20) is moved longitudinally until contact with a stop restricts further longitudinal movement of the saddle means, whereupon the other end of the saddle means is engaged with the other end of the subarray.

10. An apparatus for recovering a seismic subarray of a float (11), gun support beam (15) and umbilical cable (14) from the water to onboard a towing ship (10) which is underway, characterised

by saddle means (20); rudder means (28) attached to the saddle and functionable to laterally align the saddle (20) with the float (11); and a landing rail (23, 24) on the float which is operative to engage the saddle means (20) and restrict further lateral movement of the saddle means (20).

11. The apparatus of Claim 10 including a feeler arm (27) operative to position the rudder means (28) alongside the float (11).

12. The apparatus of Claim 10 wherein the landing rail (23, 24) is operative to restrict the saddle means (20) from lateral movement but permit longitudinal movement with respect to the float (11).

13. The apparatus of Claim 12 including means for moving the saddle (20) longitudinally along the float (11) into engagement with a forward lifting rail which is functionable to prevent further longitudinal movement of the saddle (20).

14. The apparatus of Claim 11 including means for moving the saddle (20) longitudinally along the float (11) into engagement with a forward lifting rail which is functionable to prevent further longitudinal movement of the saddle (20).

Patentansprüche

1. Verfahren zum Bergen eines Schleppkörpers aus dem Wasser auf ein in Fahrt befindliches schleppendes Schiff (10), gekennzeichnet durch folgende Schritte: Positionieren des Schleppkörpers längsseits des oder hinter dem Schiff; Ausrichten einer Sattelvorrichtung (20) seitlich am Schleppkörper; Ausfahren einer mit der Sattelvorrichtung verbundenen Rudervorrichtung (28) ins Wasser in die Nähe des Schleppkörpers; Bewegen der Sattelvorrichtung im Zusammenwirken mit dem Ruder in eine Position unmittelbar über des Schleppkörpern; und Absenken der Sattelvorrichtung zum Ineingriffbringen mit einem Ende des Schleppkörpers.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die in Eingriff gebrachte Sattelvorrichtung (20) durch eine hintere Ladeschiene an einer seitlichen Bewegung am Schleppkörper (11) gehindert, jedoch frei ist, sich in Längsrichtung am Schleppkörper um die Länge der hinteren Landeschiene (23) zu bewegen.

3. Verfahren nach Anspruch 2, dadurch gekennzeichnet, daß die Sattelvorrichtung (24) in Längsrichtung bewegt wird, bis ein Ende der hinteren Landeschiene (23) eine weitere Längsbewegung der Sattelvorrichtung hindert, worauf die Sattelvorrichtung abgesenkt und mit einer vorderen Landeschiene (24) am anderen Ende des Schleppkörpers in Eingriff gebracht wird.

4. Einrichtung zum Bergen eines Schleppkörpers (11) aus dem Wasser auf ein in Fahrt befindliches schleppendes Schiff (10), gekennzeichnet durch eine Sattelvorrichtung (20), eine Rudervorrichtung (28), die unmittelbar oder mittelbar über einen Fühlerarm (27) mit der Sattelvorrichtung (20) verbunden und dazu verwendet ist, die Sattelvorrichtung (20) am Schleppkörper (11) seitlich auszurichten, und durch eine Vorrichtung, mit der ein Ende der Sattelvorrichtung (20) mit dem Schleppkörper (11) in Eingriff bringbar ist und die eine weitere seitliche Bewegung der Sattelvorrichtung (20) verhindert.

5. Einrichtung nach Anspruch 4, gekennzeichnet durch eine Vorrichtung zum Bewegen der Sattelvorrichtung (20) in Längsrichtung zum Schleppkörper (11) zum in Eingriff bringen mit einer Hebeschiene am anderen Ende des Schleppkörpers (11).

6. Verfahren zum Bergen einer seismischen Baugruppe aus einem Schwimmkörpers (11), einem Einzieh- und Versorgungskabel aus dem Wasser auf ein in Fahr befindliches schleppendes Schiff (10), gekennzeichnet durch folgende Schritte: Positionieren der Baugruppe längsseits des oder hinter dem Schiff; Ausrichten einer Sattelvorrichtung (20) mit dem Schwimmkörper der Baugruppe; Ausfahren einer mit der Sattelvorrichtung verbundenen Rudervorrichtung (28) ins Wasser in die Nähe des Schwimmkörpers; Bewegen der Sattelvorrichtung im Zusammenwirken mit dem Ruder in eine Position unmittelbar über dem Schwimmkörper; und Absenken der Sattelvorrichtung zum Ineingriffbringen mit einer Landeschiene (24) auf dem Schwimmkörper.

7. Verfahren nach Anspruch 6, dadurch gekennzeichnet, daß ein Fühlerarm (27) dazu verwendet wird, das Ruder (28) längsseits des Schwimmkörpers (11) zu positionieren.

8. Verfahren nach Anspruch 6, dadurch gekennzeichnet, daß die in Eingriff gebrachte Sattelvorrichtung (20) an der seitlichen Bewegung am Schwimmkörper (11) gehindert, jedoch frei ist, sich längs der Landeschiene (23) in Längsrichtung zu bewegen.

9. Verfahren nach Anspruch 8, dadurch gekennzeichnet, daß die Sattelvorrichtung (20) in Längsrichtung soweit bewegt wird, bis eine Berührung mit einem Stoppelement eine weitere Längsbewegung der Sattelvorrichtung verhindert, worauf das andere Ende der Sattelvorrichtung mit dem anderen Ende der Baugruppe in Eingriff gebracht wird.

10. Einrichtung zum Bergen einer seismischen Baugruppe aus einem Schwimmkörper (11), einem Träger (15) und einem Versorgungskabel (14) aus dem Wasser auf ein in Fahrt befindliches schleppendes Schiff (10), gekennzeichnet durch eine Sattelvorrichtung (20), eine Rudervorrichtung (28), die mit dem Sattel verbunden ist und dazu dient, den Sattel (20) am Schwimmkörper (11) seitlich auszurichten, und durch eine Landeschiene (23, 24) auf dem Schwimmkörper, die mit der Sattelvorrichtung (20) in Eingriff bringbar ist und die eine weitere seitliche Bewegung der Sattelvorrichtung (20) verhindert.

11. Einrichtung nach Anspruch 10, gekennzeichnet durch einen Fühlerarm (27), mit dem die Rudervorrichtung (28) längs des Schwimmkörpers (11) in Position bringbar ist.

12. Einrichtung nach Anspruch 10, dadurch gekennzeichnet, daß die Landeschiene (23, 24) die Sattelvorrichtung (20) an einer seitlichen Bewe-

gung hindert, jedoch eine Längsbewegung zum Schwimmkörper (11) hin zuläßt.

13. Einrichtung nach Anspruch 12, gekennzeichnet durch eine Vorrichtung zum Bewegen des Sattels (20) längs des Schwimmkörpers (11) zum Ineingriffbringen mit einer vorderen Hebeschiene, die dazu dient, die weitere Längsbewegung des Sattels (20) zu verhindern.

14. Einrichtung nach Anspruch 11, gekennzeichnet durch eine Vorrichtung zum Bewegen des Sattels (20) längs des Schwimmkörpers (11), zum Ineingriffbringen mit einer vorderen Hebeschiene, die dazu dient, die weitere Längsbewegung des Sattels (20) zu verhindern.

Revendications

1. Procédé de récupération d'un corps remorqué (11) à partir de l'eau, à bord d'un navire remorqueur (10) faisant route, caractérisé par les étapes de positionnement du corps remorqué le long ou derrière le navire; alignement d'un moyen de support en forme de selle (20) latéralement par rapport au corps remorqué; déploiement d'un moyen de gouvernail (28) attaché au moyen de support en forme de selle, dans l'eau, au voisinage du corps remorqué; déplacement du moyen de support en forme de selle en coordination avec le gouvernail dans une position directement au-dessus du corps remorqué; et abaissement du moyen de support en forme de selle de façon à saisir une extrémité du corps remorqué.

2. Procédé selon la revendication 1 caractérisé en ce que le mouvement latéral du moyen de support en forme de selle (20) engagé est restreint sur le corps remorqué (11) par un rail de débarquement arrière, mais que son déplacement longitudinal sur le corps remorqué est permis par le prolongement du rail de débarquement arrière (23).

3. Procédé selon la revendication 2 caractérisé en ce que le moyen de support en forme de selle (24) est déplacé longitudinalement jusqu'à ce qu'une extrémité du rail de débarquement arrière (23) arrête le mouvement longitudinal du moyen de support, après quoi le moyen de support est abaissé et saisit un rail de débarquement avant (24) à l'autre extrémité du corps remorqué.

4. Dispositif pour récupérer un corps remorqué (11), de l'eau à bord d'un navire remorqueur (10) faisant route, caractérisé par des moyens de support en forme de selle (20); des moyens de gouvernail (28) attachés directement ou indirectement, à travers un bras palpeur (27), au moyen de support (20) et pouvant aligner latéralement le moyen de support (20) avec le corps remorqué (11); et des moyens pour engager une extrémité du moyen de support (20) avec le corps remorqué (11) et restreindre tout mouvement ultérieur latéral du moyen de support (20).

5. Dispositif selon la revendication 4 comprenant un moyen pour déplacer le moyen de support en forme de selle (20) longitudinalement sur le corps remorqué (11) de façon à l'engager avec un rail de levage à l'autre extrémité du corps remorqué (11).

6. Procédé pour récupérer un dispositif sismique d'un flotteur (11), un poisson et un câble ombilical, de l'eau à bord d'un navire remorqueur (10) faisant route, caractérisé par les étapes de positionnement du dispositif sismique le long ou derrière le navire; alignement d'un moyen de support en forme de selle (20) avec le flotteur du dispositif sismique; déploiement d'un moyen de gouvernail (28) attaché au moyen de support, dans l'eau, à proximité du flotteur; déplacement du moyen de support en coordination avec le gouvernail dans une position directement au-dessus du flotteur; et abaissement du moyen de support de façon à saisir un rail de débarquement (24) sur le flotteur.

7. Procédé selon la revendication 6 caractérisé en ce qu'un bras palpeur (27) est utilisé pour positionner le gouvernail (28) le long du flotteur (11).

8. Procédé selon la revendication 6 caractérisé en ce que le déplacement latéral du moyen de support engagé (20) sur le flotteur (11) est restreint mais que son déplacement longitudinal est permis le long du rail de débarquement (23).

9. Procédé selon la revendication 8 caractérisé en ce que le moyen de support (20) est déplacé longitudinalement jusqu'à contacter une butée qui arrête la poursuite du mouvement longitudinal du moyen de support, après quoi l'autre extrémité du moyen de support s'engage avec l'autre extrémité du dispositif sismique.

10. Dispositif pour la récupération de l'eau d'un dispositif sismique constitué par un flotteur (11), une poutre de support de fusil (15) et un câble ombilical (14), à bord d'un navire remorqueur (10) faisant route, caractérisé par un moyen de support en forme de selle (20); un moyen de gouvernail (28) attaché à la selle et pouvant aligner latéralement la selle (20) avec le flotteur (11); et un rail de débarquement (23, 24) sur le flotteur, pouvant fonctionner de façon à engager la selle (20) et restreindre le mouvement latéral ultérieur de cette selle (20).

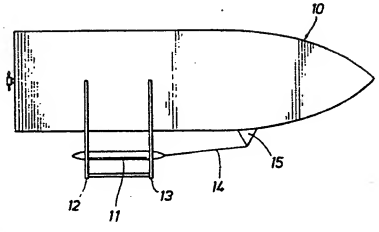
11. Dispositif selon la revendication 10 comprenant un bras palpeur (27) pouvant positionner le moyen de gouvernail (28) le long du flotteur (11).

12. Dispositif selon la revendication 10 caractérisé en ce que le rail de débarquement (23, 24) peut restreindre le mouvement latéral du moyen de support en forme de selle (20) mais permettre son mouvement longitudinal par rapport au flotteur (11).

13. Dispositif selon la revendication 12 comprenant un moyen pour déplacer la selle (20) longitudinalement le long du flotteur (11) de façon à l'engager avec un rail de levage avant qui peut empêcher le mouvement longitudinal ultérieur de la selle (20).

14. Dispositif selon la revendication 11 comprenant un moyen pour déplacer la selle (20) longitudinalement le long du flotteur (11), de façon à l'engager avec un rail de levage avant qui peut empêcher le mouvement longitudinal ultérieur de la selle (20).

FIG.1



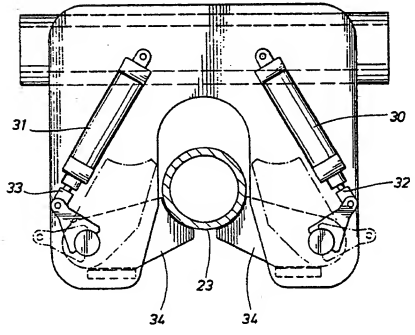


FIG.3

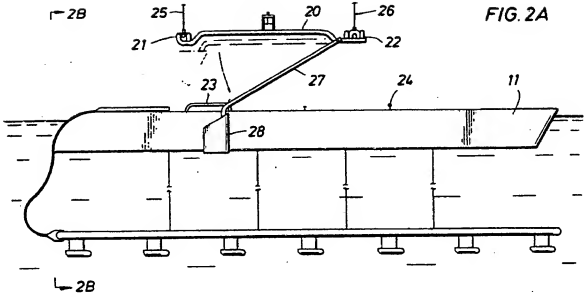


FIG. 2A

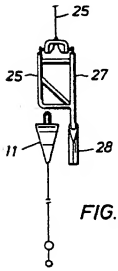


FIG. 2B

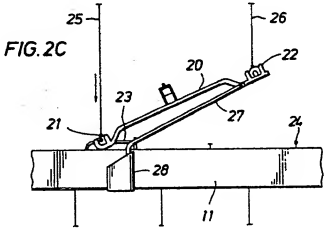


FIG. 2C

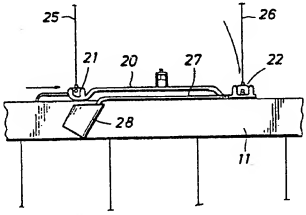


FIG. 2D